GEOMETRY.

426. Proposed by R. D. CARMICHAEL, Indiana University.

On a given chord of a circle as a base construct an isosceles triangle, with vertex outside of the circle, such that its sides shall be divided in a given ratio by their points of intersection with the circle.

CALCULUS.

347. Proposed by R. D. CARMICHAEL, Indiana University.

Show that the differential equation

$$9\left(\frac{d^2y}{dx^2}\right)^2\frac{d^5y}{dx^5} - 45\frac{d^2y}{dx^2}\frac{d^3y}{dx^3}\frac{d^4y}{dx^4} + 40\left(\frac{d^3y}{dx^3}\right)^3 = 0$$

remains unchanged when the variables x and y undergo any projective transformation (Goursat-Hedrick, *Mathematical Analysis*, p. 86, ex. 18).

348. Proposed by E. L. DODD, University of Texas.

Let $(x_1, x_2, \cdots x_n)$ be a point in n dimensions lying in the "sphere" S defined by

$$x_1^2 + x_2^2 + \cdots + x_n^2 \leqq 1.$$

Let T be that part of S defined by a set of n linear homogeneous inequalities with non-vanishing determinant; thus:

$$a_ix_1 + b_ix_2 + \cdots + k_ix_n \geqq 0, \quad i = 1, 2, \cdots n.$$

Find the value of

$$\frac{\int_T \cdots \int dx_1 \cdots dx_n}{\int_S \cdots \int dx_1 \cdots dx_n};$$

in other words, find the magnitude of a "solid angle" in n dimensions, with the "sphere" as unit solid angle.

Note.—This problem was discussed and left unsolved by Schläfli in the Quarterly Journal of Mathematics for 1858, 1860, 1867. EDITOR.

349. Proposed by C. N. SCHMALL, New York City.

If $y = a\cos(\log x) + b\sin(\log x)$, eliminate the constants a and b and obtain the equation

$$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0.$$

MECHANICS.

282. Proposed by R. P. LOCHNER, Philadelphia, Pa.

A car weighing 10 tons (2,240 lb. each) attains a speed of 15 miles per hour from rest in 24 seconds, during which it covers 100 yards. If the space-average of the resistances is 30 lb. per ton, find the average horse-power used to drive the car. (Morley's "*Mechanics for Engineers*," p. 66).

283. Proposed by C. N. SCHMALL, New York, N. Y.

The maximum length of a certain chain which can be suspended from one end without breaking is l. It is desired to form a catenary with a length $2l/k$ of the chain, the points of support being a distance d apart, in the same horizontal line.

Show that the maximum value of d is $\frac{2l}{k}(k^2 - 1)^{\frac{1}{2}}\log\left(\frac{k+1}{k-1}\right)^{\frac{1}{2}}$.

NUMBER THEORY AND DIOPHANTINE ANALYSIS.

199. Proposed by R. P. LOCHNER, Philadelphia, Pa.

Find three integral squares such that the sum of every two of them shall be a square.—Alsop's "Algebra."